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ETV and adult education
multichannel programing
South Carolina Educational Television Center
Southern Bell Telephone and Telegraph Company
community uses of ETV
Columbia, South Carolina
instructional television

South Carolina was a state slow in development, 49th in per-capita income and 47th in illiteracy. However, educational inadequacies have been recognized and cooperative efforts were made to uplift the people educationally, economically, and socially.

Part I described the need to make changes in the educational process. The closed-circuit approach to educational television (ETV) was adopted. The cooperation of telephone companies made the cost feasible. The program started in 1958-59 with two school subjects in five classrooms at a cost of $60,000. In 1963, 155 public high schools, eight colleges, and the State university with its five extension centers were involved at a cost of $1,295,000. Basic ETV policies included the use of teamwork teaching, concentration upon basic subjects, the production and preservation of courses on video tape, and the use of the finest quality technical equipment.

Educator acceptance has increased. The legislature has wholeheartedly backed the program which is planned to continue until all schools, including private schools and independent colleges, can have ETV. Important parallel services were teacher training, adult education, and community use of a six channel system operating from 8 a.m. to 10 p.m.

Part II described in detail the requirements, the transmission facilities, and the developmental efforts of the area telephone companies to provide a practical and highly reliable network. The costs were comparatively low -- $14 per pupil above previous costs. Eight maps showed cable systems and stations.

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THE SOUTH CAROLINA ETV STORY

Part I

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Summary. South Carolina devotes over 50 per cent of its tax dollars to education. This state is 49th in per capita income and 47th in illiteracy. This part describes the need for institutional teaching by television to up-grade the South Carolina educational level. This part also discusses the need for multi-channel programming of ETV thereby challenging the subject of open circuit versus closed circuit as a medium of transmission.

This is a report on education in South Carolina at all levels with a brief review of inadequacies and shortcomings of the past and a summary of recent and current efforts to uplift all of the people of a whole state educationally, economically and otherwise after nearly a century of compounded backwardness.

An inherently proud people, more than 85 per cent nativeborn, most South Carolinians have roots reaching back to Colonial and Revolutionary times. Indeed South Carolinians were powerful and constructive factors in the birth and establishment of this nation.

Then came the War Between the States - four years of disaster followed by the terrible and humiliating period of Reconstruction.

The climb back has been incredibly slow and frustrating. Actually, it was not until after World War II that South Carolina began to secure a significant foothold in the national economy, departing from a one-crop agricultural economy into diversified farming, and even more profitably into an industrial development offering good promise of a balanced economy.

Many of the nation's major corporations already are operating plants in this state appreciating the vast undeveloped natural and human resources. South Carolinians generally are sturdy people, toughened by adversity and knowing no other way to advance except by earning their own way. Eager for gainful employment, they are demonstrating a healthy understanding of the demands of these times for better education and training. In short, South Carolinians are hungry for progress and what it takes to achieve it.

With this general background of a state and its people in mind, let us focus on an examination of education, or perhaps more accurately, on the lack of adequate education an opportunity for most of the people.

The bulk of this paper, then, is an earnest attempt to portray with stark even embarrassing facts and figures the needs and the hopes for better education for all of the people at all levels in the state.

It was not until the nineteen-twenties that the State government entered into a comprehensive program of State financed public schools. Prior to that each district, and there were some 1,200 of them, did the best it could. The result was that in many respects there were 1,200 different systems of education in the State. Actually, the education system in South Carolina was deplorably typical of the rest of life in the state with an impoverished general economy. There simply were no ways and means or much positive leadership to do better. But following the depression, and with much greater national attention focused on the whole South, circumstances began to change.

Desperate conditions brought determined efforts and today, after a remarkable revival, South Carolina ranks seventh from the top in relative financial efforts for education. The state allocates half of every tax dollar for education as compared

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with only 33 cents on the average in other states. Approximately 120 million dollars a year is the current spending rate for education.

One of the most heroic but unpublicized stories in the recent history of the nation has been this effort of South Carolinians, with great financial sacrifice, to educate their children. Within the last ten years the taxpayers have accepted a 3 per cent general sales tax, even on food and medicine, with all proceeds ear-marked for education. Income taxes have been sharply raised with the addition of 6% and 7% brackets. Excise taxes on gasoline, tobacco, soft-drinks, alcoholic beverages and other items are all among the very highest in the nation.

But the people have not complained, knowing that the lion's share of tax income was going to education. Paradoxically, however, notwithstanding all of this effort South Carolina continues to face the following realities as set forth in a recent survey report of the National Education Association:

1. South Carolina students drop out of high school or fail at a faster rate than those in any other state in the union.

2. Nearly 62% of South Carolina registrants failed the selective service mental test in 1959 - the highest failure in the nation.

3. The state's illiteracy rate based on persons 14 years old or older who cannot read or write is 7.9 per cent of the population - exceeded only by Louisiana's 9.8 per cent.

4. The state ranks 43rd in average daily attendance, with only 87 per cent.

5. One of four South Carolina citizens has not been to school more than five years.

6. Of adult citizens over 25, only 27 per cent are high school graduates.

We could go on and on with data, all revealing the fact that South Carolina is either at the bottom or next to the bottom in practically all basic areas of educational achievement. And, to compound the problem, South Carolina has the highest number of school age children per wage earner in the nation.

Thus, South Carolina faces not only the enormous new demands of the modern world for education of higher and higher quality, but it is recognizing and combatting more than ever before an immeasurable accumulation of cultural and economic backwardness with which the people have been afflicted for at least 100 years. This backwardness is especially acute among the state's Negro population which represents approximately 40 per cent of the whole.

On the brighter side there prevails in South Carolina a strong and growing desire among the people as a whole, and various substantial elements in particular, for immediate and extensive educational improvement at all levels. This thirst for progress has been building rapidly in practically every area of life. Educational leaders, more aware than others of the state's inadequacies and shortcomings, have constantly sought to impress upon the public the importance of meeting educational needs.

Governors and legislative leaders have moved constructively and substantially with all feasible speed and resources to bring about improvements. Business, industrial, and agricultural forces have worked independently and together to encourage and expedite programs required by the new economic revolution in the state. Parent-teacher associations, chambers of commerce, civic and service clubs, and other organizations have thrown their wholehearted support behind a new South Carolina with the full realization that the state and its people can advance no faster than educational limitations and opportunities permit.

All of the activity is not new, but it is accurate to say that only in recent years has general awareness to needs been such that dispersed and heretofore frustrated elements have begun to arrive at common grounds of endeavor. One of the most tangible evidences of merging forces has been the annual Governor's Conference on Education, Industry and Agriculture inaugurated in 1959 under the inspiration of Governor Hollings and the South Carolina Association of School Boards. This conference so far has dealt largely with bringing the state's problems into focus but it is expected more and more in the fu-

ture to engage in specifics. Already it has resulted in a program to consolidate all state educational agencies into a single, well-coordinated system.

In other words, the facts of educational backwardness are well known to South Carolinians. Various and exhaustive studies have been conducted. Professional management consultants, educational authorities from outside the State, South Carolina educators themselves, laymen, and legislators in separate and joint surveys have probed into the whole area and selected areas of education. The truths, good and bad, have been disclosed for all to see. If ever a state has needed and wanted a fundamental overhauling of its educational system, it is South Carolina. We firmly believe that the best way to educate children is to give all of them the best available teaching in all subjects. We submit that this goal is utterly impossible under the present processes of education. Furthermore, the predominant keynote of educational spokesmen today for more and more money as a solution to the acknowledged problems of education is not a solution but in our economic context would provide mainly just more of the same kind of teachers and teaching that we now have.

Obviously, then the time has come to revolutionize the mediums and paces and guidance of education. We proposed to do this through the general application at all levels and on practically all basic subjects of the greatest means of communication yet developed - television.

Educational television had been tested all over the nation and in South Carolina with results so convincing that no longer is there any doubt of its effectiveness. Although most experiments over the rest of the nation were being conducted on open-circuit, we felt that open-circuit, limited to one channel, could never really scratch the surface of what is needed in educational television.

And so South Carolina adopted the closed circuit cable approach to ETV from the outset of its program in 1957-58. This program has been publicly rated as the nation's first statewide closed-circuit network with no limit to multi-channel operation.

It is our understanding that ETV planners in some other states which had begun ETV ahead of us had also seen the dead-end of open-circuit, one-channel operations. But when they approached the telephone companies inquiring about the costs of closed-circuit they were quoted on the basis of the only existing tariffs - those which apply to commercial television.

In South Carolina there were twelve open-circuit commercial stations. We approached the telephone company, with this question: You now have twelve television customers, if we offered the possibility of more than TWELVE HUNDRED customers would the rates be the same?

The South Carolina Southern Bell Telephone Company accepted the challenge and assigned a staff of experts to see what costs would be feasible. The cooperation of Southern Bell as well as that of all independent telephone companies in the state has been magnificent.

The State Department of Education, working overtime with the telephone company, precisely spotted every school in South Carolina on county-wide maps. We got an answer, an enormously encouraging one - an answer that convinced the legislature that a multi-channel system of ETV reaching every school in the state would be both technically and financially feasible within a matter of three to six years, depending upon the rate of funds appropriated.

The amazing progress made in South Carolina may best be illustrated by our rate of growth. ETV started in South Carolina in 1957-58 with two subjects being taught in five classrooms in one Columbia school. The appropriation was $60,000, permitting only the cheapest equipment with students as cameramen and only one professional technician.

The next year the system was expanded to five Columbia schools teaching three subjects. Then in 1960-61 we headed into a statewide development reaching 15 counties and 31 high schools with four subjects. In 1961-62 the system reached out to 65 high schools in 21 of the State's 46 counties carrying seven high school subjects, plus three teacher-training courses in elementary mathematics from the University of Texas; audio-visual aids from the University of Wisconsin, and biology from the Columbia Broadcasting System. The appropriation was

$800,000. By January, 1963, the system has expanded until it encompasses 155 public high schools, 4 private colleges, 4 state colleges, and the University of South Carolina and 5 Extension Centers. Thus, in five years appropriations were multiplied 20-fold from $60,000 to $1,295,000.

And, we say with some pride every dollar so far spent on educational television has been South Carolina taxpayers' money appropriated 100 per cent by the South Carolina legislature.

Other basic ETV policies have been and as we foresee it, will continue to be as follows:

1. Exclusive application of teamwork teaching with a classroom teacher in all classes at all times. (We have emphasized that instead of taking any teachers away from the children we provide TWO teachers for every class).

2. Concentration upon basic, everyday, difficult-to-teach subjects wherein the teacher shortage has been most chronic.

3. Use of only the finest quality technical equipment available with professional technicians well paid replacing all students as operatives from the makeshift beginning.

4. As far as possible producing and preserving all complete courses on video-tape.

General acceptance, among the rank-and-file educators has steadily increased. Legislators, annually frustrated by the sky-rocketing financial demands for conventional methods, have voted in every instance the full amounts requested for ETV. Every recorded vote in both houses of the legislature has been two-to-one or better for educational television.

Top-flight educators apprised early of every step in the program have been among the most effective salesmen of ETV. These included the State Superintendent of Education, Jesse T. Anderson; the former President of the University of South Carolina, Dr. Robert L. Sumwalt; the President of Clemson College, Dr. Robert C. Edwards; and others. Many other educators, as we understand is true over the nation, have watched and waited.

Advocates of ETV have been meticulous in keeping government officials and legislators informed. The Governor, Lieutenant Governor, the Speaker of the House, the Chairman of the Senate Finance Committee, the Chairman of the Senate Education Committee, the Chairman of the House Ways and Means Committee, the Chairman of the House Education Committee, and many others have spoken out publicly for educational television.

They have generally cited the pressing need for positive action to raise education in South Carolina from its low rank. They have maintained that it is the duty and responsibility of educators to apply the most effective and economical methods and tools, with emphasis upon ETV as the best instrument yet advanced to catch up with the "average" states and then to surpass them. They have pointed out that the State could never catch up by keeping the same conventional pace which has held us at the bottom for so long.

We feel it remarkable that not a single one of the original, basic policies of the ETV advocates has had to be essentially altered or reversed.

We are overjoyed that South Carolina has arrived at a point where there is considerable interest in extending educational television on a full-fledged scope to every public educational institution in the state, applying the most modern techniques of teaching from the first grade through the twelfth grade of elementary and secondary education in established public schools, a total of 1,246 schools, plus the creation of an experimental series of junior colleges in existing high school buildings at selected population centers during the afternoon and evening hours, and a series of industrial training centers now being planned by the state in strategic population areas. Then, finally, to inaugurate as soon as feasible an extensive regular system of instruction television for the state-supported colleges reaching a total of five campuses.

Incidentally, four independent colleges and two parochial schools, perhaps the first such schools in the nation directly connected

with a public school system, are now receiving our full ETV service simply by paying the phone company to tap in at no extra expense whatever to the state. We see no limit to the possibilities of such participation by independent schools and colleges.

As an important parallel service we propose through the same multi-channel system to schedule a comprehensive program of teacher training at all levels, plus the inauguration of significant adult education programs, public service activities and other educational and informational projects. The possibilities of after-school-hours use of the multi-channel system for public health, civil defense, etc., are practically unlimited.

With this comprehensive program we hope to establish for the benefit of this state and the nation the effectiveness and potential of an all-inclusive statewide system of educational television. We believe it to be of major and immediate importance to the whole nation not only to prove educational excellence through teamwork teaching and video taped courses, but to light the way to multi-channel operations through a closed circuit system as the most feasible and economical plan of communicating to an entire state at all levels and at varying paces, where desirable, the best available teaching on all subjects.

The goal of the program we have outlined, as we envision it now, is to reach six channels of transmission with up to 725,000 regular school and college students participating on a full scale basis once the six channel system is accomplished.

And please remember this figure: The per student cost of everything above what is being spent now on conventional classroom teaching would amount to approximately $14 per pupil per year. This cost would be about 8 per cent of the pupil expenditures today in South Carolina public schools alone. Figured another way the cost per school for 1,250 schools would amount to only $8,000 a year per school. This is roughly the cost of two present classroom teachers.

Thus, by altering very slightly the teacher-pupil ratio on several subjects educational television in South Carolina would easily pay its own way. If educational television in time substantially alters teacher-pupil ratios the possibilities of higher salaries for the classroom teachers themselves would be more feasible without undue extra burdens upon taxpayers. It would seem that the immediate future, with soaring pupil enrollments, would be a reasonable time for some adjustments in teacher-pupil ratios since it would not affect employment of classroom teachers at present, but would permit absorption by present teachers of some of the enrollment increases without adding so many extra new teachers. The truth is that no authorities anywhere have come forth yet with information as to where all the extra new teachers might be found.

Now, and mark this, with all of the transmission, studio facilities, and equipment, receiving sets in all schools, and other overhead already paid and accounted for in the $14 per pupil cost of the system, the costs of after-hours use for teacher training, adult education and various other educational and public service programs would be relatively insignificant. This would be doubly true of the three summer months as transmission and the other costs, including all technical and production personnel, are covered year-round in the annual $14 per pupil cost.

With six channels based on 8 a. m. to 10 p. m. transmission, there would be possible 84 hours per day of instruction. This would provide and transmit 168 subjects of 30 minutes duration or considerably more subjects if, as anticipated, many elementary grade level subjects would be of ten, fifteen and twenty minute duration.

There you have it - the story of ETV in South Carolina - a story not yet told in its entirety. We don't have all the answers but we do know that through ETV we can offer a unique educational opportunity to all the citizens of South Carolina.

Mr. W. R. Knight, Jr., Chief Engineer, Southern Bell Telephone and Telegraph Company, Columbia, South Carolina, prepared Part II of the South Carolina ETV Story which describes the transmission facilities furnished by the Southern Bell and Independent telephone companies as well as some of the developmental efforts of the Bell System to provide a practical and highly reliable network.

THE SOUTH CAROLINA ETV STORY

Part II

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Chief Engineer
Southern Bell Telephone and Telegraph Company
Columbia, South Carolina

Summary. South Carolina is the first state in the union to develop a statewide closed circuit television network for institutional type teaching. This part describes that portion of the project involving the transmission facilities which were furnished by the Southern Bell Telephone and Telegraph Company and the independent telephone companies. In addition some of the developmental efforts of the Bell System in creating such a system are included.

Following Part I of this program you can appreciate that we in the Telephone Companies were being asked for the first time to look seriously at developing a method of instructional teaching by video. Up until this time most planning, as best we can determine, was based upon: "Have X dollars - what can we get." We were indeed glad to have an opportunity for a group of educators to tell us in the communications business what they wanted - present and future. This venture gave the communications people and educators an opportunity to offer and counter-offer as to needs versus costs.

The success of the 1959 four-school trial in Columbia brought forward the question of off-air versus closed circuit method of providing ETV in South Carolina. While Part I of the paper discusses generally the engineering consideration these are the facts established as a result of the study:

1. A multi-channel system would be required so as to program a number of different grades from Elementary through High School level - to say nothing of Junior College.

2. To cover the state by use of off-air UHF station, Figure 1, coverage would require far more channels than available. In our study it was found that about 72 stations (transmitters) at about 24 to 27 locations would be required to provide only three-channel operation. From this came the closed-circuit study and we abandoned looking at six-channel off-the-air methods.

3. The open or closed circuit medium would require intercity or intercounty facilities for tying UHF stations or cable distribution feeder points together to furnish the number of subjects of direct sequential teaching desired by the ETV Commission.

4. Closed circuit cable distribution points were established by plotting each school in the state then limiting the cable system to 50 amplifiers in tandem (or roughly 35 miles), Figure 2. Strangely enough we came up with some 47 distribution points, some fewer than the UHF TV station coverage, with a capacity of six channels now rather than three channels under the abandoned UHF TV station study.

5. If by further technical developments it were possible to extend the cable distribution system from 35 to 50 miles the number of cable distribution feeder points could be reduced from 47 to 19, Figure 3. Even more impressive is the thought of a 60 mile-cable distribution system of six channels, Figure 4. Such a system would require only 10 or 12 microwave tie-in (or feed) points.

6. By incorporating paired conductors

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around the coaxial tube two benefits accrue: namely, stiffening of the cable to better protect and facilitate plowing operation, and providing an economic advantage of having the dual services under one sheath.

7. By taking into consideration the ultimate system required, we can design and program the job more economically than has been possible in a great number of ventures, that is, of "starting with something that is inadequate because an agency only has so-many-dollars". With this arrangement we can now determine:

   A. Which route should be via cable initially, or ultimately. Perhaps better stated: which route should first be provided by microwave and ultimately replaced with a cable system as TV channel requirements increase.

   B. Which area can best be served by UHF off-air initially converting to cable to conform with multi-subject teaching and retain the UHF broadcast station for adult education or one-channel use.

Here are some of the compromises made by the ETV Technical Committee to bring costs into perspective as compared to commercial TV requirements:

No stand-by protection channel.

No automatic switching between channels.

No stand-by A. C. power.

Repair on call-out basis.

An audio bandwidth of at least 5 KC. (Better than 10 KC band furnished by use of diplexer)

Video bandwidth better than that useable by commercially available receivers but less than the minimum specified by commercial broadcast requirements.

So much for the over-all study results. Planning and doing are two different problems when time is of the essence. In December, 1959, the Sub-Committee began to actively talk with us about enlarging the closed circuit network as used in Columbia: more specifically, about extending service to Charleston, Aiken, Barnwell, Camden, Sumter, Orangeburg, Greenville, Anderson, Spartanburg, and Florence by September 1, 1960. See Figure 5. They were advised that if a firm order were received by February 15, 1960, all service requested could be furnished. However, due to an extended session of the Legislature, no order was received February 15, and another order date of March 15 was suggested.

In the meantime plans had been formulated as to how the network could be provided should the order for the service materialize. It was proposed to use one channel of the new Columbia-Charleston TD-2 radio relay route which was scheduled for message service in November, 1960, and provide appropriate junction equipment to serve intermediate schools along the way. In addition to these arrangements, it would be necessary to construct a side-leg with a light-route microwave system from the Blackville repeater station on the Columbia-Charleston TD-2 route to serve Barnwell. If required, it was assumed that the protection channel of the new TD-2 route northwest to Greenville could be used temporarily as a backbone facility in that direction. Plans for the extension of service east to Camden, Sumter and Florence were to add a video channel to the new Columbia-Sumter 6 Gc microwave route. Camden would be served by constructing a side-leg radio route from the Blaney Station on the Columbia-Sumter route using 6 Gc equipment. Service to Florence would be accomplished by constructing a 6 Gc radio link from the Spring Hill Station of the Columbia-Sumter route to the Hartsville repeater station on the Charlotte-Florence TD-2 route and extending to the Florence central office via TD-2 microwave.

Taking a calculated risk that the order would ultimately be received, we ordered 100 amplifiers and associated equipment from Spencer-Kennedy Laboratories in Boston, Massachusetts. Also, a contact was made with the Collins Radio Company of Dallas, Texas, regarding the possibility of furnishing microwave endlinks which would be needed for the extension of service to Barnwell,

Camden, Sumter, Florence, Spartanburg, Anderson and Orangeburg. Simultaneously, the Western Electric Distributing House was informed of our expected needs for TD-2 microwave equipment and 270,000 feet of coaxial cable. In May an order was placed for 200,000 feet of cable even though a firm order for service had not as yet been received.

March 15 came and went with no firm order having been received from the ETV Committee. Finally, the appropriations bill was passed which provided that a state ETV Commission would be established.

On June 30, 1960, the new Commission gave us an order for service to Swansea, Blackville, Barnwell, Allendale, Charleston, Blaney, Camden and Sumter. This order provided that Southern Bell handle the complete transmission job, both video and audio, from the output of their cameras or tape machines in the Columbia ETV Studio to the input of their receivers within the classrooms throughout the State.

Even though considerable preliminary work had been done while anticipating the ultimate receipt of an order for the service, a tremendous amount of engineering, construction and installation work was yet to be done in two months time if the desired service date were to be met. The major items included in this were provision of 234 miles of microwave video channels involving construction of two new towers, nearly a hundred miles of coaxial distribution cable with the associated amplifiers, and the installation of over one-half million dollars worth of terminating equipment. To add to the difficulties, some of the equipment required from several suppliers had to be manufactured by people who had been called back from vacation, and some had to be assembled in the plants' model shops in order to meet our schedule. The coaxial distribution cable amplifier stations had to be assembled upon arrival in Columbia by a special crew of Western Electric Company installers. Special cable splicing tools had to be borrowed from the Chesapeake and Potomac Company of Maryland who had earlier installed a similar coaxial cable network at Hagerstown.

Early in the spring, with only the anticipation of an order for the service on which to plan, several classes were held to instruct engineers in the transmission design of coaxial distribution cable. Schools were also held to instruct plant men in the art of coaxial cable splicing. Almost continuous conferences were held in South Carolina with members of the Company Headquarters Staff in Atlanta, the A. T. & T. Company, and Bell Telephone Laboratories as well as with the various manufacturers, suppliers, and contractors who might be involved in the undertaking.

While Southern Bell engineers and plant people burned considerable midnight oil and used plenty of elbow grease to make the deadline to which they had committed themselves, some other people were also having to hurry and make every minute count: These were the ETV Commission Staff who were involved in readying a building, formerly used as a supermarket, for their new ETV studios for service by the same September 1 deadline. The completion of their facilities in the time available was nothing short of phenomenal. Their cameras, video taping equipment, props and other appointments are second to none in the telecasting industry.

With superb coordination and diligent work by the various groups involved in the effort, the network was completed with a few days to spare. These few (ten) days were most appreciated by the ETV people who needed the opportunity to orient the classroom instructors as well as to provide the technicians and others with practice in operating the system. The network as placed in service on September 1, 1960 is shown in Figure 6. With the inauguration of this service, South Carolina's educational television program became unique in at least two respects: It was the only closed circuit state-wide network and it was the first such network to utilize 100% video taped operation.

In November nine additional schools were added to the network in Florence, Sumter, Hartsville, Darlington, and Mid Carolina High near Chapin. Following this on January 21, 1961, service was extended to Spartanburg and Clinton, adding four more schools. The final addition to the network for the school year 1960-1961 was made with the connection of the new Cardinal Newman Catholic High School in Columbia on May 1, 1961. This is significant, as part of the ETV Commission's policy is to make televised instruction available to private schools as well as to the public system, or to any group or

individual as long as no additional cost to the state is involved. Following these extensions the network appeared as shown in Figure 5.

Then on May 5, 1961, an order was received which resulted in the extension of service to Anderson, Greenwood, Rock Hill, Lancaster, Chester, Greenville, Clemson, Bishopville and Manning, involving 15 additional schools. In addition, nine schools were connected to the existing network at Allendale, Charleston, Columbia, Florence, and Spartanburg prior to the starting of the 1961-1962 school year. Figure 7 shows the layout of the network as of September 1, 1961.

Up to this point service on the network has involved a single television channel which when fully utilized during the school day provides 12 half-hour class sessions during a six-hour period. The May, 1961 order provided for three-channel operation in Columbia that year. The ETV Commission is now studying a plan which will utilize up to four or more channels to proportionately multiply the capabilities of the full state-wide system. This plan if applied together with completing the coverage of all high, junior high, and elementary schools of the State, represents a challenge of no small magnitude to the telephone industry should we be called upon to furnish these facilities. Figure 8 shows this layout as was projected for the entire state.

As you can see, ETV in South Carolina is a going concern. It keeps us busy, not only expanding; but, developing new arts and techniques as well. When the first network was placed into service audio channels were provided separately, Figure 9, to the cable distribution points. This was done primarily for two reasons: (1) The ETV Commission elected to use the lowest commercial tariff in lieu of construction costs. (2) All theory indicated the probability of diplexing the audio and video signals would degrade the video signal if we tried to transmit the combined sound and picture information over more than one hop of baseband microwave. ("Baseband" as used in this paper denotes that the interconnection between microwave receiver and transmitter at repeater points is made at video frequencies.)

The separate audio facility with its limited bandwidth was proven experimentally by the ETV Technical Committee to be completely unsatisfactory for the transmission of French or Music lessons. By the use of a diplexer we now transmit combined audio and video signals over the same facility. This method of transmission involves placing the audio in the frequency spectrum above the video band by the use of a 6.2 megacycle subcarrier. The net result is the ability to furnish a wide band (15 KC) circuit at about a third the cost of the original limited bandwidth audio network. The resulting audio and video signal tests on a 5-hop baseband system are of such quality as to be highly satisfactory to the ETV Technical Committee.

Our rapidly growing ETV network is being integrated with telephone facilities. Changes, such as the addition of cable pairs around the coaxial tube under a common sheath, have been developed by Bell Telephone Laboratories and the Western Electric Company, Figure 10. These cable pairs can be used for the provision of telephone message circuits between communities as the ETV network expands.

The attenuation of coaxial cable varies with the ambient temperature and the highest temperature encountered dictates the maximum amplifier spacings. By taking advantage of lower temperatures encountered below the earth's surface, we have been able to extend amplifier sections some 500 additional feet. This length alone reduces the number of amplifiers required by about 20%. In order to effect these savings, we again required the services of the Bell Telephone Laboratories to develop a plow which would protect the tube against flattening and be capable of placing the cable 32 to 40 inches below ground level and at the same time accommodate maximum size composite cables (Coaxial tube and paired conductors). See Figure 11.

A trial of a new system utilizing push-pull type amplifiers is now underway between Orangeburg and St. George, South Carolina. This cable system will be used in lieu of a three-hop microwave system, Figure 12. I'd like to predict that the outcome of this trial will permit much longer cable systems for television signal distribution and the savings that will accrue when additional channels are placed in service will be nothing short of phenomenal when compared with the costs for additional channels via microwave.

In conclusion, let me say that the ever expanding Educational Television Network of South Carolina represents a substantial investment by the State, the Independent Telephone Companies, and the Bell System. Many eyes are eagerly watching the growth of the network from the technical as well as the educational standpoint. The benefits derived from the program underway should result in the indisputable upgrading of education at all levels in South Carolina and it is conceivable that it could be the beginning of a Nationwide Educational Television Network. We of the Telephone Industry are extremely proud to be a part of such a tremendous undertaking. Its reliability as indicated by Figure 13 further supports our pride in this enterprise.

Part I of this ETV Story was authored by Mr. R. Lynn Kalmbach, General Manager, South Carolina Educational Television Center, which describes the need for institutional teaching by television to up-grade the South Carolina educational level. This part also discusses the need for multi-channel programming of ETV thereby challenging the subject of open circuit versus closed circuit as a medium of transmission.

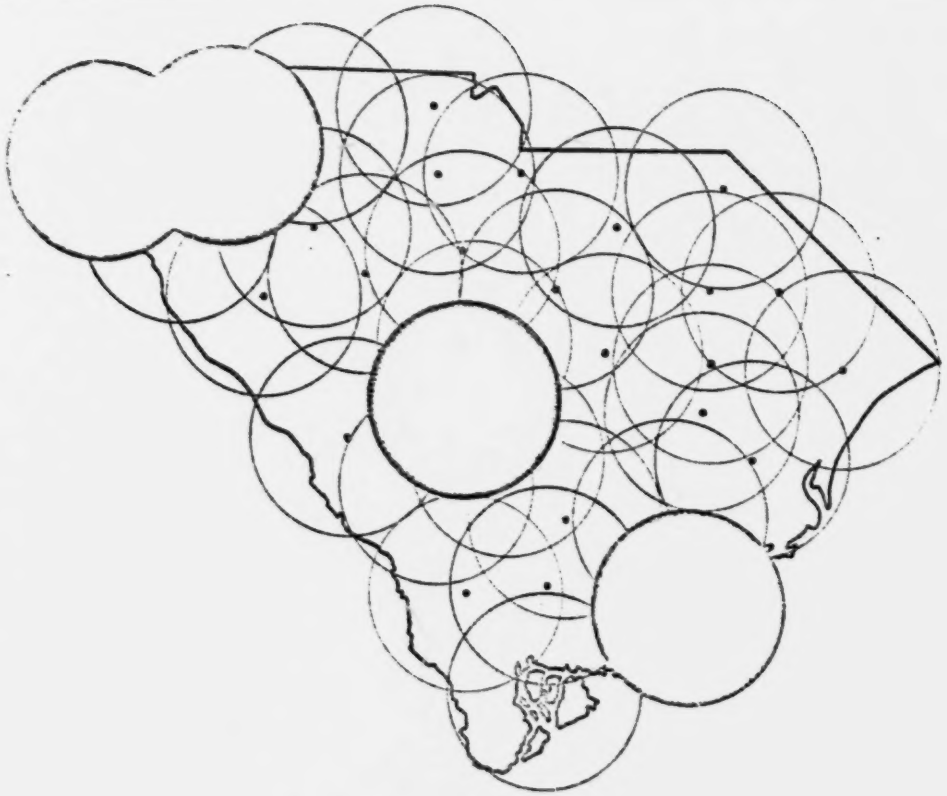


Figure 1. A minimum of 24 to 27 UHF broadcast stations equipped with 72 transmitters would be required to cover the state for 3-channel operation.

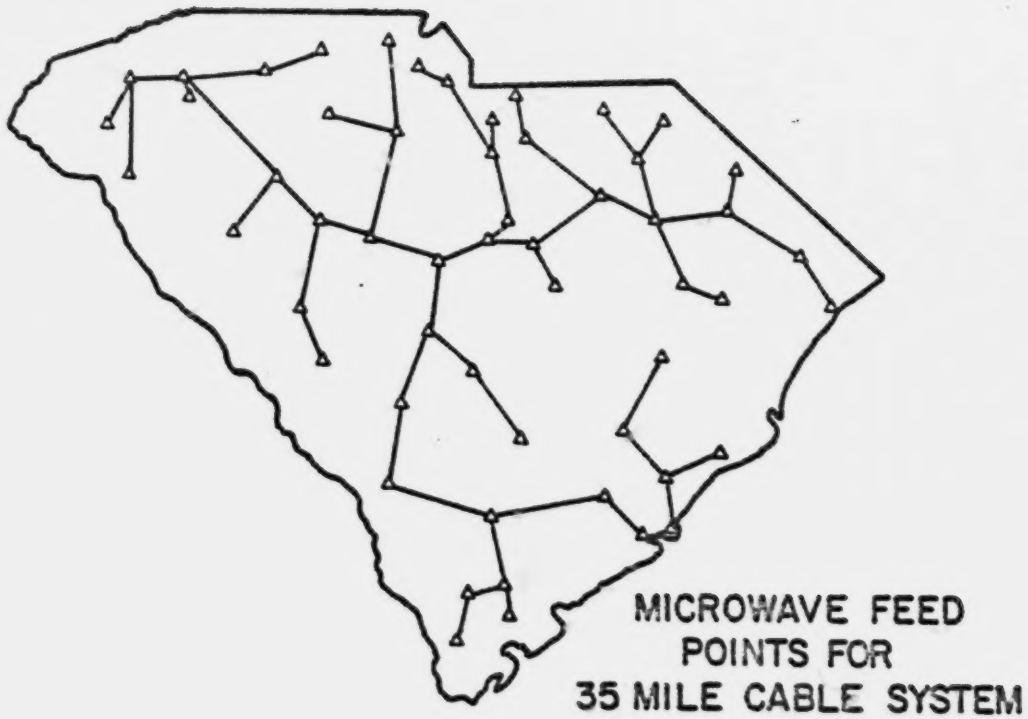


Figure 2. Microwave fundamental layout projected to feed coaxial cable systems limited to 35 miles.

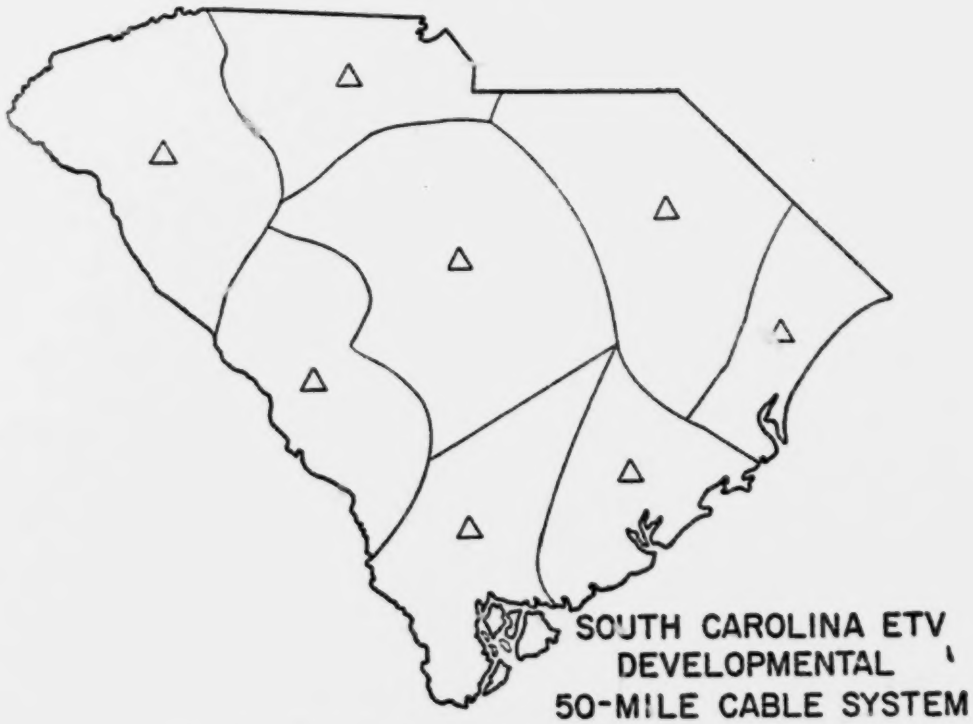


Figure 3. Blocked-out areas that could be served by a 50-mile coaxial cable system.

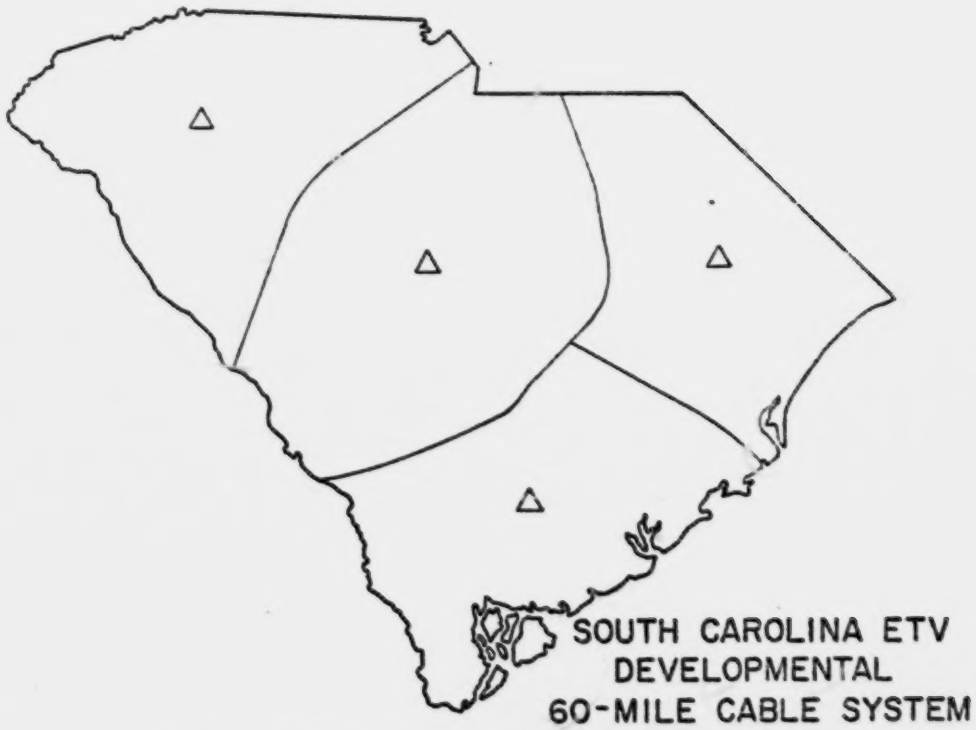


Figure 4. Blocked-out areas that could be served by a 60-mile coaxial cable system.

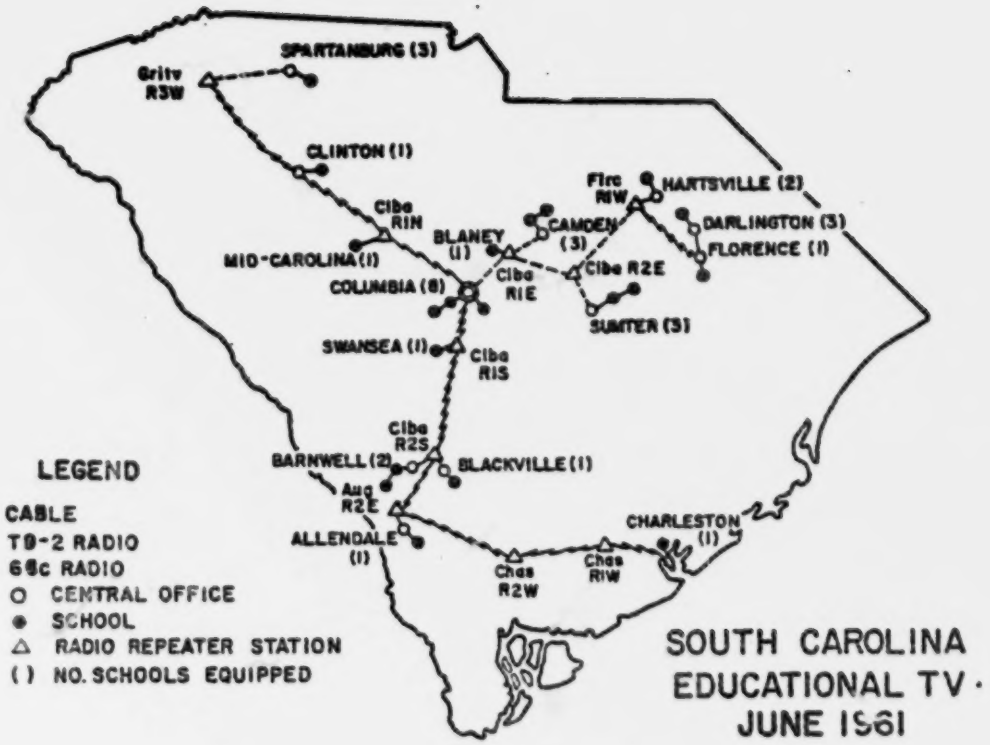


Figure 5. Network coverage as of June 1, 1961 to serve 25 schools in 15 towns.

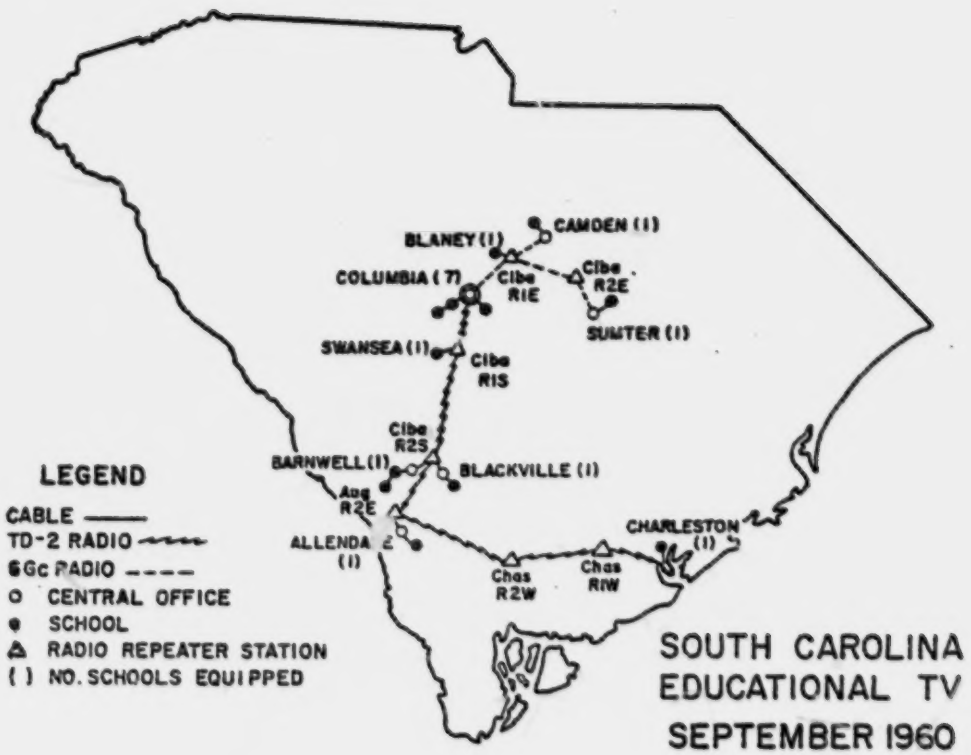
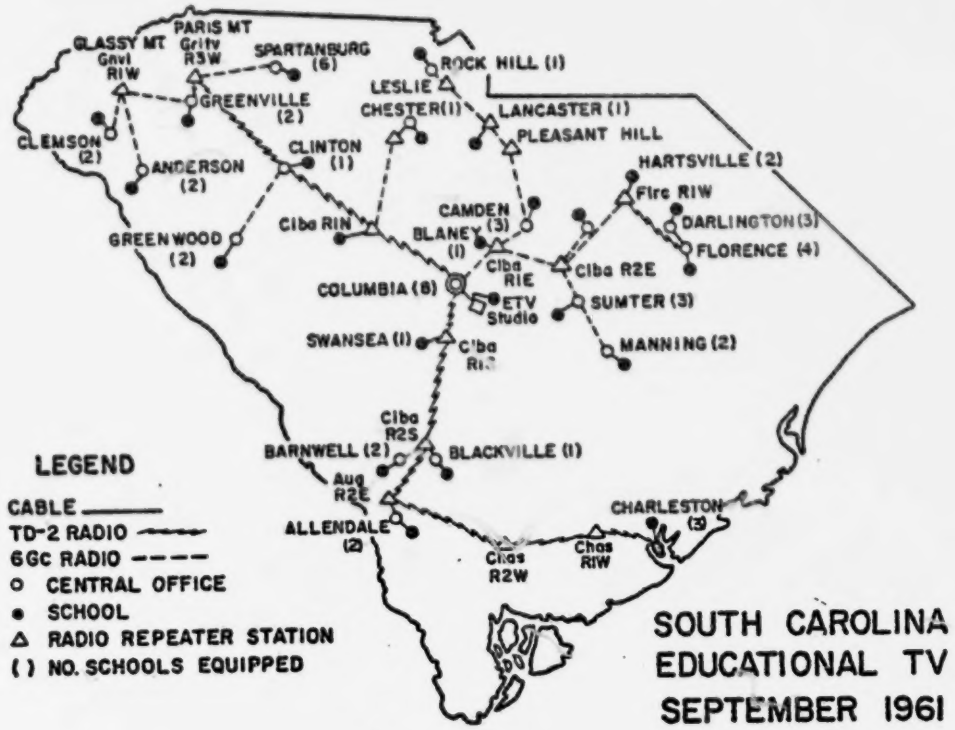


Figure 6. Network expanded to serve 15 schools in 9 cities for school year 1960-61, from modest beginning of 5 schools in Columbia previous year.



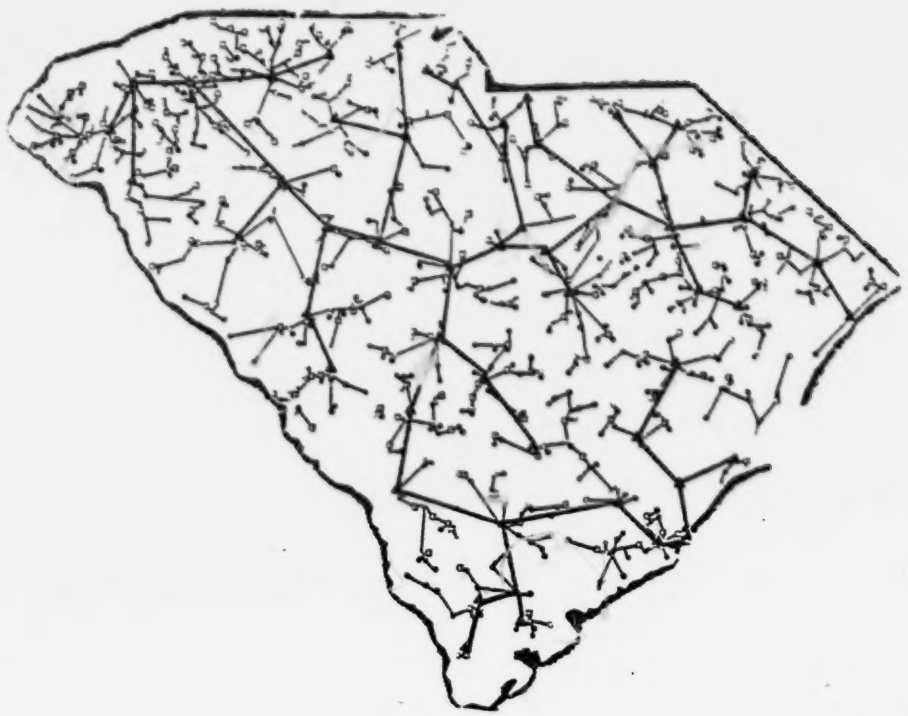


TABLE XV d. SUMMARY OF WRITTEN COMMENTS, 1963-64 REGIONAL ETV SURVEY

Program and Grade	General Evaluation: Favorable	General Evaluation: Unfavorable	Specific Suggestions Regarding Changes or Additions to TV Programs	Freq.	Probl. with Guide: Not Avail.	Probl. with Guide: Arriv. Too Late	Probl. with Guide: Inconsis. With Program	Commendation of Specific Program or Instructor	Freq.
Span. I	1	7	More English translation	10	5		1 (better form)		
Gr. 6			Too much vocabulary and not enough time to learn it	8					
			Students feel teacher is "talking down"	6					
			Want more repetition and review	4					
			More booklets for students	3					
			Present written as well as oral words	3					
			Provide more opportunity for stud. oral participation	3					
			Guides inadequate for teacher with little or no Span.	3					
			Increase features like baseball game, fiesta, puppet shows and dramatizations	2					
			More emphasis on vocabulary building and basic grammar	2					
			Supplement with tape recordings	1					
			Tests too easy	1					
			Less repetition but more written drill	1					
			Instructor not dynamic enough	1					
			More drill on complete sentences	1					
			Program guide would be more usable if verbatim script of TV program	1					
Span. II			Teacher speaks too fast	2		2	1		
Gr. 5			Provide student workbooks	2					
			Additional pupil participation, esp. in Spanish	1					
			Use more English	1					
			More visual material in program	1					

Figure 7. Network included 56 schools in 25 towns by September 1, 1961. 3-channel operation began in Columbia schools at this same time.

Figure 8. Fundamental closed-circuit 6-channel layout developed with capability for serving all high, junior high, and elementary schools in a state.

TABLE XV e.

SUMMARY OF WRITTEN COMMENTS, 1963-64 REGIONAL ETV SURVEY

Program and Grade	General Evaluation: Favorable	General Evaluation: Unfavorable	Specific Suggestions Regarding Changes or Additions to TV Programs	Freq.	Probl. with Guide: Not Avail.	Probl. with Guide: Arriv. Too Late	Probl. with Guide: Inconsis. With Program	Commendation of Specific Program or Instructor	Freq.
Span. II Gr. 6	2	9	More explanation in English	24	17	21	9	Highest interest in tests	2
			Need workbooks for each child	11				Man's approach	1
			Visual as well as oral presentation of Spanish words	9				Enjoyed playing "Simon Says" in class	1
			Want conversation slower	7				Baseball game	1
			Woman talked down to pupils	6				Music and dancing	1
			62-63 program superior to 63-64	3					
			Relate program to grade level	3					
			Need special Spanish teacher to follow up in class	3					
			Less repetition of programs	3					
			Less repetition per word	2					
			Man sings in monotone	2					
			Charts should be larger	2					
			Too much vocabulary, not enough time to learn it	2					
			Want visual material for student workbook	1					
			Have special lists of songs to be sung	1					
			Relate content more to classroom than home	1					
			Work old items into new ones throughout year	1					
			Childish and uninteresting	1					
			Discontinue "pseudo-discovery" method	1					
			Make tests easier to administer, correct and grade by per cent	1					
			More clarification at times pupils are to participate	1					
			Songs pitched too low	1					
			Want more tests	1					
			Include more study of people and places in South America and Spain	1					
			Frequent (2 times monthly?) visits to classrooms by consultants	1					
			Better song teaching	1					
			Increase number of ways same content can be used	1					
			Program with outside talent best	1					
			Include records and workbooks	1					